Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE **13 FEB 2012**	2. REPORT TYPE **N/A**	3. DATES COVERED **-**

4. TITLE AND SUBTITLE **Stem cells in large animal models of retinal and neurological disease**	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) **Klassen H., Tucker B. A., Liew C. G., La Cour M., Wang H. C.,**	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR’S ACRONYM(S)
	11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a REPORT **unclassified**	b ABSTRACT **unclassified**	c THIS PAGE **unclassified**	**UU**	**2**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Hindawi Publishing Corporation
Stem Cells International
Volume 2012, Article ID 460504, 2 pages
doi:10.1155/2012/460504

Editorial

Stem Cells in Large Animal Models of Retinal and Neurological Disease

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Received 13 February 2012; Accepted 13 February 2012

The mammalian central nervous system (CNS) is notable in terms of complexity and sophistication, but also for a very limited regenerative ability in the face of injury and disease. While it is not uncommon to find remarkable regenerative capabilities in the CNS tissues of fish and amphibian species, similar findings are much more limited in reptiles and quite difficult to replicate in mammals. One method used to circumvent this inherent limitation has been the use of fetal tissue transplantation which has resulted in evidence of graft survival, integration and functional repair in a number of rat [1, 2] and also mouse models. Nevertheless, the use of fetal tissue grafts is generally impractical as a source of donor material and of relatively limited utility in the adult human eye [3]. Stem cell transplantation has more recently emerged as a potential treatment modality that offers even greater potential for tissue integration, while also being more scalable for widespread therapeutic use.

Much progress has been made in the development of stem cell transplantation in rodent models of retinal disease [4–6]; however, limitations to rodent-based research include nonhuman features such as small eyes, rod-dominated vision, the absence of a macula or visual streak, and short life span. As stem cell research moves toward clinical application in ophthalmology, the value of modeling and refining transplantation procedures in larger mammals becomes increasingly evident.

This special issue includes 10 papers that focus on stem and progenitor cells from the central nervous system (both brain and retina) of nonrodent mammals, or cells modified to resemble such cells (e.g., iPS cells), together with the development of useful allogeneic donors and recipients. Although any species is of potential interest, here there is a particular emphasis on pig and cat following on from previous work conducted in these species.

The reports included in this special issue represent an interesting range of animals, including a nonhuman primate, as well as experimental approaches, including genetic modification and tissue engineering. Collectively, they serve to extend both the scope and horizon of stem cell research in nonrodent mammalian species. Despite the challenges of such work, it can be hoped that further efforts will be made to harness the potential of this area for translation of basic research findings into the clinical domain, not only as preclinical models for human treatment, but also as bone fide veterinary applications.

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